

Claims

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1. A low temperature electrochemical method for removing specie X from compound MX, comprising the steps of:
 - A. forming an electrolysis system comprising a MX cathode, an anode, and a non-aqueous ionic liquid electrolyte;
 - 10 B. passing a current through said system at a voltage determined to remove X from MX;
 - C. isolating the reaction product resulting from removal of X from MX.
 2. The method according to claim 1, where M is selected from the group consisting of a metal, a metal compound, or a semi-metal compound.
 - 15 3. The method according to claim 1, where M is selected from the group consisting of Ti, Si, Ge, Zr, Hf, Sm, U, Al, Mg, Nd, Mo, Cr, Li, La, Ce, Y, Sc, Be, V or Nb, or alloys thereof or mixtures thereof.
 4. The method of claim 1 or 10, wherein X is selected from the group consisting of O, C, N, S, P, As, Sb, or a halide.
 - 20 5. The method according to claim 1 or 10, wherein X is oxygen.
 6. The method according to claim 1 or 10, wherein said non-aqueous solvent is a chloroaluminate system based on nitrogen heterocyclic cations or functional equivalent thereof.
 7. The method according to claim 1 or 10, wherein said non-aqueous solvent is
25 selected from the group consisting of mono and dialkylimidazolium salts.

8. The method according to claim 1 or 10, wherein said non-aqueous solvent is a mixture of 1-ethyl-3-methylimidazolium chloride and aluminum chloride.
9. The method according to claim 1 or 10, wherein said solvent is 1-ethyl-3-methylimidazolium tetrafluoroborate.
- 5 10. A low temperature electrochemical method for removing O from TiO_2 , comprising the steps of:
 - A. forming an electrolysis system comprising a TiO_2 cathode, an anode, and a non-aqueous ionic liquid electrolyte;
 - B. passing a current through said system at a voltage selected to remove O
10 from said TiO_2 ;
 - C. isolating the reaction product resulting from the removal of O from TiO_2 .